Materials Science

SYNTHESIS OF A POLYETHYLENE-LIKE FILM USING PLASMA POLYMERIZATION, H. A. Kostalik IV, J. F. Evans*, University of Minnesota Duluth, Department of Chemistry, Duluth, MN 55812, jevans1@d.umn.edu

Polymeric thin films deposited from radio frequency non-equilibrium discharges are of applied interest due to their advantageous chemical surface properties. Surface or interfacial properties play a critical role in biomedical applications. Synthesis and modification of a hydrocarbon layer on bulk Teflon is the primary goal of this project. This would create a material adequate for cell adhesion and growth while retaining the non-polar functionality and mechanical properties of bulk Teflon. An external electrode plasma reactor was used along with neat ethylene and 1-octene gas. Fourier transform infrared spectroscopy (FTIR) was used to characterize the chemical composition of the polymerized thin film. Deposition quantity and rate was determined by integration of selected peaks. Silicon was used as a substrate due to its transparency. The power of the plasma was varied and deposition rate recorded. As the power increased the deposition rate increased linearly. Previous evidence suggests that long lived radicals may be present in the bulk of the plasma leading to polymerization in the bulk and transfer to the substrate surface. The plasma was pulsed to determine the presence of long lived radicals. Deposition quantity remained constant for both pulsed and continuous plasmas. This suggests that there are no long lived radicals present in the bulk, and the primary mechanism for polymerization is the initiation and propagation at the surface of the substrate. To achieve a polymer with little cross-linking and long hydrocarbon chain length ethylene gas was used. The FTIR spectrum indicated a highly cross-linked structure with short hydrocarbon chain length. In order to extend the chain length 1-octene gas was used. A reduction in methyl character and increase in methylene character was observed. Unfortunately no long chain band in the FTIR spectrum was identified indicating the hydrocarbon chain did not exceed three carbons in length. No contamination in the form of carbonyl and hydroxyl groups was detected in any of the FTIR spectrums.